

**WHAT IS CLAIMED IS:**

- 1 / 1. An electrostatic discharge protection circuit with high
- 2 trigger current, coupled to a node and a reference
- 3 potential for dissipating the electrostatic voltage
- 4 formed at said node, said electrostatic discharge
- 5 protection circuit comprising:
- 6 a substrate having a first conductivity type, coupled to
- 7 said reference potential;
- 8 a well region having a second conductivity type, formed on
- 9 said substrate and coupled to said node;
- 10 a first doping region having said first conductivity type,
- 11 electrically floated on said well region; and
- 12 a second doping region having said second conductivity
- 13 type, disposed on said substrate and electrically coupled
- 14 to said reference potential;
- 15 wherein, the electrostatic discharge current of said node
- 16 provides a voltage with sufficient magnitude to breakdown
- 17 the conjunction interface between said well region and said
- 18 substrate, also triggering a BIPOLAR JUNCTION
- 19 TRANSISTOR (BJT) comprising said well region, said substrate
- 20 and said second doping region, for dissipating said
- 21 electrostatic discharge current;
- 22 and wherein said first doping area, when the electrostatic
- 23 discharge current is greater than a predetermined current,
- 24 reduces the potential difference between said node and said
- 25 reference potential

1 2.The electrostatic discharge protection circuit as claimed  
2 in claim 1, wherein said electrostatic discharge protection  
3 circuit further comprises a third doping area having said  
4 second conductivity type, disposed in said well region,  
5 electrically coupled to said node, for forming an ohmic  
6 connection at said well region.

Sub A7  
1 3.The electrostatic discharge protection circuit as claimed  
2 in claim 1, wherein said electrostatic discharge protection  
3 circuit further comprises a forth doping region having said  
4 first conductivity type, disposed at the surface of said  
5 substrate near said well region, electrically coupled to  
6 said reference potential, for forming an ohmic connection  
7 at said substrate.

8  
9 4.The electrostatic discharge protection circuit as claimed  
10 in claim 1, wherein said first conductivity is p-type, and  
said second conductivity is n-type.

Sub A27  
1 5.The electrostatic discharge protection circuit as claimed  
2 in claim 1, wherein said electrostatic discharge circuit  
3 further comprises a fifth conductivity type having said  
4 second conductivity type, disposed at the conjunction of  
5 said well region and said substrate, for reducing the  
6 breakdown voltage at the conjunction of said well region  
7 and said substrate.

1 6.The electrostatic discharge protection circuit as claimed  
2 in claim 1, wherein said electrostatic discharge protection  
3 circuit further comprises a field oxide layer, disposed at  
4 the surface of said substrate adjacent to said fifth doping  
5 region.

Sub A37 7. The electrostatic discharge protection circuit as claimed  
in claim 1, wherein said electrostatic discharge protection  
circuit further comprises a MOS resistor having a first  
conductivity type disposed on said substrate and comprising  
a gate and two source/drain regions, wherein one of said  
source/drain regions is electrically coupled to said well  
region, while the other of said source/drain regions,  
together with said gate, is electrically coupled to said  
reference potential.

8. The electrostatic discharge protection circuit as claimed  
in claim 4, wherein one of said drain/source regions of  
said MOS resistor having said first conductivity type is  
comprised of said fifth doping region, and the other of  
said drain/source regions of said MOS resistor having said  
first conductivity type is comprised of said second doping  
region.

9. The electrostatic discharge protection circuit as claimed  
in claim 7, wherein one of said drain/source regions of  
said MOS resistor having said first conductivity type is  
comprised of said fifth doping region, and the other of  
said drain/source regions of said MOS resistor having said  
first conductivity type is comprised of said second doping  
region.

10. The electrostatic discharge protection circuit as  
claimed in claim 1, wherein said electrostatic discharge  
protection circuit further comprises:

a MOS resistor having said first conductivity type, formed  
on said substrate, comprising a gate, and two source/drain  
regions, wherein one source/drain region is electrically

7 coupled to said well region, and the other source/drain  
8 region is electrically coupled to said reference potential;  
  
9 a resistor, its two ends electrically coupled to said gate  
10 and said reference potential, respectively; and  
  
11 a capacitor, its two ends electrically coupled to said gate  
12 and said node, respectively.

1 11. An electrostatic discharge protection circuit with high  
2 trigger current, coupled to a node and a reference  
3 potential, for dissipating the electrostatic discharge  
4 current from said node, comprising:

5 a BJT, comprising an emitter, a base and a collector,  
6 wherein said emitter and said base are electrically coupled  
7 to said reference potential, said collector is comprised of  
8 a collector region with a second conductivity type and  
9 electrically coupled to said node; and

10 a first doping region having a first conductivity type,  
11 floated in said collector region, and forms a junction  
12 interface with said collector region;

13 wherein said first doping region, when said electrostatic  
14 discharge current is greater than a predetermined current,  
15 reduces the potential difference between said node and said  
16 reference potential.

1 12. The electrostatic discharge protection circuit as  
2 claimed in claim 11, wherein said electrostatic discharge  
3 protection circuit further comprises a MOS resistor having  
4 a first conductivity type, disposed on said substrate,  
5 comprising a gate, and two source/drain regions, wherein  
6 one of said source/drain regions is electrically coupled to

7 said collector, while the other source/drain region,  
8 together with said gate, is electrically coupled to said  
9 reference potential.

1 13. The electrostatic discharge protection circuit as  
2 claimed in claim 11, wherein said electrostatic discharge  
3 protection circuit further comprises:

4 a MOS resistor having said first conductivity type,  
5 comprising a gate, and two source/drain regions, wherein,  
6 one source/drain regions is electrically coupled to said  
7 node, and the other source/drain is electrically coupled to  
8 said reference potential;

9 a resistor, its two ends electrically coupled to said gate  
10 and said reference potential, respectively; and

11 a capacitor, its two ends electrically coupled to said gate  
12 and said node, respectively.

1 14. The electrostatic discharge protection circuit as  
2 claimed in claim 11, wherein said first conductivity is p-  
3 type, and said second conductivity is n-type.

1 15. The electrostatic discharge protection circuit as  
2 claimed in claim 1, wherein said first conductivity is n-  
3 type, and said second conductivity is p-type.

4 16. The electrostatic discharge protection circuit as  
5 claimed in claim 10, wherein said first conductivity is n-  
6 type, and said second conductivity is p-type.

1 / 17. An electrostatic discharge protection circuit with high  
2 trigger current, electrically coupled to a node and a  
3 reference potential for dissipating the electrostatic

4 voltage formed at said node, said electrostatic discharge  
5 protection circuit comprising:

6 a base having a first conductivity type, electrically  
7 coupled to said reference potential;

8 a well region having a second conductivity type, formed on  
9 said substrate and electrically coupled to said node;

10 a first doping region having said first conductivity type,  
11 electrically floated on said well region and electrically  
12 coupled to said node; and

13 a second doping region having said second conductivity  
14 type, electrically floated on said base;

15 wherein the electrostatic discharge current of said node  
16 provides a voltage with sufficient magnitude to breakdown  
17 the junction interface between said well region and said  
18 base, also triggering a BJT comprising said well region,  
19 said base and said first doping region, for dissipating  
20 said electrostatic discharge current;

21 and wherein said second doping area, when the electrostatic  
22 discharge current is greater than a predetermined current,  
23 reduces the potential difference between said node and said  
24 reference potential

1 18. The electrostatic discharge protection circuit as  
2 claimed in claim 17, wherein said electrostatic discharge  
3 protection circuit further comprises a third doping area  
4 having said second conductivity type, disposed in said well  
5 region, electrically coupled to said node, for forming an  
6 ohmic connection at said well region.

SUB A47  
2 19. The electrostatic discharge protection circuit as  
3 claimed in claim 17, wherein said electrostatic discharge  
4 protection circuit further comprises a forth doping region  
5 having said first conductivity type, disposed at the  
6 surface of said base near said well region, electrically  
7 coupled to said reference potential, for forming an ohmic  
connection at said base.

1 20. The electrostatic discharge protection circuit as  
2 claimed in claim 17, wherein said electrostatic discharge  
3 circuit further comprises a fifth conductivity type having  
4 said second conductivity type, disposed at the conjunction  
5 of said well region and said base, for reducing the  
6 breakdown voltage at the conjunction of said well region  
7 and said base.

1 21. The electrostatic discharge protection circuit as  
2 claimed in claim 1, wherein said electrostatic discharge  
3 protection circuit further comprises a field oxide layer,  
4 disposed at the surface of said base adjacent to said fifth  
5 doping region.

1 22. The electrostatic discharge protection circuit as  
2 claimed in claim 1, wherein said electrostatic discharge  
3 protection circuit further comprises a MOS resistor having  
4 a first conductivity type, disposed on said base,  
5 comprising a gate, and two source/drain regions, wherein,  
6 one of said source/drain regions is coupled to said well  
7 region, while the other source/drain region, together with  
8 said gate, is coupled to said reference potential.

1 23. The electrostatic discharge protection circuit as  
2 claimed in claim 20, wherein ~~one~~ one of said drain/source  
3 regions of said MOS resistor having said first conductivity

4 type is comprised of said fifth doping region, and the  
5 other drain/source regions of said MOS resistor having said  
6 first conductivity type is comprised of said second doping  
7 region.

Sub A57  
9 24. The electrostatic discharge protection circuit as  
10 claimed in claim 22, wherein, one of said drain/source  
11 regions of said MOS resistor having said first conductivity  
12 type is comprised of said fifth doping region, and the  
13 other drain/source regions of said MOS resistor having said  
14 first conductivity type is comprised of said second doping  
region.

1 25. The electrostatic discharge protection circuit as  
2 claimed in claim 1, wherein said electrostatic discharge  
3 protection circuit further comprises:

4 a MOS resistor having said first conductivity type, formed  
5 on said base, and comprising a gate and two source/drain  
6 regions, wherein one source/drain region is coupled to said  
7 well region, and the other source/drain region is coupled  
8 to said reference potential;

9 a resistor, its two ends coupled to said gate and said  
10 reference potential, respectively; and

11 a capacitor, its two ends coupled to said gate and said  
12 node, respectively.

1 26. The electrostatic discharge protection circuit as  
2 claimed in claim 17, wherein said electrostatic discharge  
3 circuit further comprises a sixth conductivity type having  
4 said first conductivity type, disposed at the conjunction  
5 of said well region and said base, for reducing the

6 breakdown voltage at the conjunction of said well region  
7 and said base.

1 27.The electrostatic discharge protection circuit as  
2 claimed in claim 26, wherein said electrostatic discharge  
3 protection circuit further comprises a field oxide layer,  
4 disposed at the surface of said well adjacent to said sixth  
5 doping region.

Sub A 67  
1 28.The electrostatic discharge protection circuit as  
2 claimed in claim 27, wherein said electrostatic discharge  
3 protection circuit further comprises a MOS resistor having  
4 a second conductivity type, disposed on said well region,  
5 comprising a gate and two source/drain regions, wherein one  
6 of said source/drain regions is electrically coupled to  
7 said base, while the other source/drain region, together  
8 with said gate, is electrically coupled to said node.

1 29.The electrostatic discharge protection circuit as  
2 claimed in claim 18, wherein, one of said drain/source of  
3 said MOS resistor having said second conductivity type is  
4 comprised of said sixth doping region, and the other  
5 drain/source of said MOS resistor is comprised of said  
6 third doping region.

1 30.The electrostatic discharge protection circuit as  
2 claimed in claim 28, wherein, one of said drain/source of  
3 said MOS resistor having said second conductivity type is  
4 comprised of said sixth doping region, and the other  
5 drain/source of said MOS resistor is comprised of said  
6 third doping region.

1 31.The electrostatic discharge protection circuit as  
2 claimed in claim 26, wherein said electrostatic discharge  
3 protection circuit further comprises:

4 a MOS resistor having said second conductivity type,  
5 comprising a gate, and two source/drain regions, wherein,  
6 one source/drain region is electrically coupled to said  
7 node, and the other source/drain region is electrically  
8 coupled to said reference potential;

9 a resistor, its two ends electrically coupled to said gate  
10 and said node, respectively; and

11 a capacitor, its two ends electrically coupled to said gate  
12 and said reference voltage, respectively.

1 32. The electrostatic discharge protection circuit as  
2 claimed in claim 17, wherein said first conductivity is p-  
3 type, and said second conductivity is n-type.

1 33. The electrostatic discharge protection circuit as  
2 claimed in claim 17, wherein said first conductivity is n-  
3 type, and said second conductivity is p-type.

Sub 17 34. An electrostatic discharge protection circuit with high  
1 trigger current, electrically coupled to a node and a  
2 reference potential for dissipating the electrostatic  
3 voltage formed at said node, said electrostatic discharge  
4 protection circuit comprising:  
5

6 a BJT, comprising an emitter, a base and a collector,  
7 wherein said emitter and said base are electrically coupled  
8 to said node, said collector is comprised of a collector  
9 region with a first conductivity type and electrically  
10 coupled to said reference potential; and

11 a second doping region having a second conductivity type,  
12 floated in said collector region, and forms a conjunction  
13 interface with said collector region;

14 wherein said second doping region, when said electrostatic  
15 discharge current is greater than a predetermined current,  
16 reduces the potential difference between said node and said  
17 reference potential.

1 35. The electrostatic discharge protection circuit as  
2 claimed in claim 34, wherein said electrostatic discharge  
3 protection circuit further comprises a MOS resistor having  
4 a first conductivity type, comprising a gate, and two  
5 source/drain, wherein, one of said source/drain is  
6 electrically coupled to said collector, while the other  
7 source/drain region, together with said gate are  
8 electrically coupled to said reference potential.

36. The electrostatic discharge protection circuit as  
claimed in claim 34, wherein said electrostatic discharge  
protection circuit further comprises:

4 a MOS resistor having said first conductivity type,  
5 comprising a gate, and two source/drain, wherein, one  
6 source/drain is electrically coupled to said node, and the  
7 other source/drain is electrically coupled to said  
8 reference potential;

9 a resistor, its two ends are respectively electrically  
10 coupled to said gate and said reference potential; and

11 a capacitor, its two ends are respectively electrically  
12 coupled to said gate and said node.

1 37. The electrostatic discharge protection circuit as  
2 claimed in claim 11, wherein said first conductivity is p-  
3 type, and said second conductivity is n-type.